Europe's concept and plans for a Venus Entry Probe Mission

E. Chassefière[1] & the VEP team

[1]Service d'Aéronomie, Pôle Système Solaire (IPSL), CNRS & Université Pierre et Marie Curie, 4 place Jussieu 75252 Paris Cedex 05, France

In May 2006 the European Space Agency's Science Programme plans to issue a Call for Ideas in the context of the Cosmic Vision (CV15-25) 2015-2025 (ESA publications BR-247). The CV15-25 programme is centred on four scientific questions: (i) What are the conditions for planet formation and the emergence of life? (ii) how does the Solar System work? (iii) What are the fundamental physical laws of the Universe? (iv) How did the Universe originate and what is it made of? In preparation for reacting to this Call for Ideas, we have organized the first international Venus Entry Probe Workshop (VEPW) on January 19-20 2006, at ESA/ESTEC. We feel that the further exploration of planet Venus, in the follow-up of Venus Express, now in orbit around Venus, and the japanese VCO orbiter, can address parts of the first two of the CV15-25 questions, in particular the following crucial questions :
- How can the detailed knowledge of the atmosphere of Venus, compared to that of the two other terrestrial planets, help in understanding observations of Earth-like extra-solar planet atmospheres and searching for habitability, and possibly life, signatures?
- Did Venus, which is the most Earth-like planet of the Solar System, offer suitable atmospheric and geological conditions for life to emerge at some time in the past ? Why did it evolve differently from Earth, and will Earth evolve toward a Venus-like state in the future?
- How does the Sun interact, through its radiation and particle emissions, with Venus' atmosphere, and what has been the influence of the Sun and of its evolution on the climate history of Venus?

The main measurement objectives of the proposed mission are :
- The *isotopic composition*, especially that of noble gases, which provides information on the origin and evolution of Venus and its atmosphere.
- The *chemical composition below the clouds and all the way down to the surface* with more detail than is possible using remote sensing, in order to fully characterize the chemical cycles involving clouds, surface and atmospheric gases.
- The *surface composition and mineralogy* at several locations representing the main types of Venus landforms and elevations.
- A *search for seismic activity and seismology on the surface*, and measurements at multiple locations to sound the interiors.
- *In situ* investigation of the *atmospheric dynamics*, for instance by tracking the drift of floating balloons.
- The *composition and microphysics of the cloud layer* at different altitudes and locations, by direct sampling.
- *Solar wind-atmosphere interaction processes and resulting escape* as a function of solar activity.
- *In situ* determination of the *surface heat flow* of different landforms and structure-elements.
- The *electromagnetic activity* monitoring and mapping of the planet.

The mission scenario is not completely defined at the present time. The mission will consist of a set of entry probes (descent probes and balloons) and an orbiter. An atmospheric sample return is also considered as an option.